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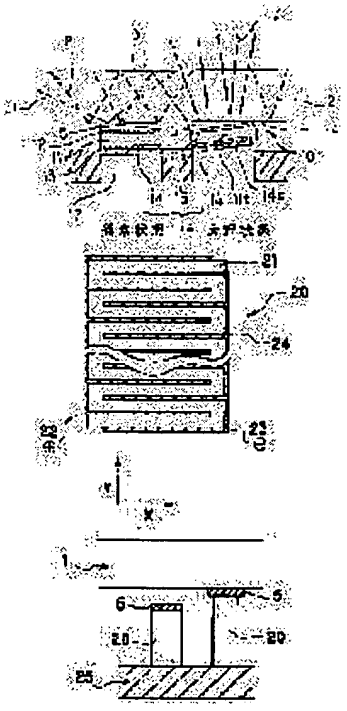
(54) OPTICAL DISPLAY ELEMENT AND DISPLAY DEVICE



(57)Abstract:
PURPOSE: To obtain a display element which is high in response speed, is low in electric consumption, is formable to a smaller size, has high screen luminance and does not require increasing of the number of pixels as compared with the number of pixels of a black and white screen even if a color screen.
CONSTITUTION: This display element is constituted to control light leakage to the prescribed section of an optical waveguide plate 1 by impressing voltage to an actuator part 10 through electrodes 12, 13 to have the standstill and displacement of this actuator part 10 executed, thereby controlling the attachment and detachment of a displacement transmission part 5 to the optical waveguide plate 1. The display element described above has the laminated actuator part 20 having a laminated piezoelectric substance 24 laminated with respectively a plurality of piezoelectric layers 21 consisting of ceramics and the electrode layers 22, 23, a fixing part 25 for fixing the laminated actuator part 20, the displacement transmission part 5 connected to the laminated actuator part 20 and the optical

waveguide plate 1 which is arranged in proximity to the displacement transmission part 5 and into which light is introduced. This display device is constituted by arranging a plurality of such display elements.

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CLAIMS

[Claim(s)]
[Claim 1] The actuator section which has the piezo electric crystal film and at least one pair of electrodes of both sides of this piezo electric crystal film which cover at least a part, respectively, The oscillating section which supports this actuator section in contact with one electrode of the electrodes of this 1 pair, The fixed part which fixes this oscillating section so that this oscillating section can vibrate, and the displacement transfer section linked to this actuator section, It comes to have the photoconductive corrugated plate into which this displacement transfer section is approached, it is arranged, and light is introduced. The display component characterized by controlling the light leak of the predetermined part of said photoconductive corrugated plate by impressing an electrical potential difference to said actuator section through said electrode, making quiescence and the variation rate of said actuator section perform, and controlling the contact to said photoconductive corrugated plate of said displacement transfer section, and

elongation.
[Claim 2] The display component according to claim 1 which constitutes the base which this oscillating section and this fixed part are united, and consists of ceramics and by which dead air space is formed in this base so that this oscillating section may be pressing hard.
[Claim 3] The display unit characterized by controlling the light leak of the predetermined part of a photoconductive corrugated plate by arranging two or more display components according to claim 1 or 2, being constituted, impressing an electrical potential difference to the actuator section through an electrode, making quiescence and the variation rate of the actuator section perform, and controlling the contact to the photoconductive corrugated plate of the displacement transfer section, and elongation.
[Claim 4] The laminating actuator section which has the multilayer piezoelectric transducer with which it comes to carry out two or more laminatings of the piezo electric crystal layer which consists of ceramics, and the electrode layer, respectively, The fixed part which fixes this laminating actuator section, and the displacement transfer section linked to this laminating actuator section, It comes to have the photoconductive corrugated plate into which this displacement transfer section is approached, it is arranged, and light is introduced. By impressing an electrical potential difference to said laminating actuator section through said electrode layer, making quiescence and the variation rate of said laminating actuator section perform, and controlling the contact to said photoconductive corrugated plate of said displacement transfer section, and elongation The display component characterized by controlling the light leak of the predetermined part of said photoconductive corrugated plate.
[Claim 5] The display unit characterized by controlling the light leak of the predetermined part of a photoconductive corrugated plate by arranging two or more display components according to claim 4, being constituted, impressing an electrical potential difference to the laminating actuator section through an electrode layer, making quiescence and the variation rate of the laminating actuator section perform, and controlling the contact to the photoconductive corrugated plate of the displacement transfer section, and elongation.
[Claim 6] The display unit according to claim 3 or 5 characterized by performing monochrome display and color display with the display component of the same number.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] Power consumption of this invention is small and it is related with the

big display component of screen intensity, and the display unit using this display component.
[0002]
[Description of the Prior Art] From the former, CRT (cathode lei tube) and liquid crystal are known as a display unit. As CRT, although the usual television is known, and a screen is bright, there is a problem that power consumption is large and the depth of the whole display unit becomes large as compared with the magnitude of a screen.
[0003] On the other hand, although liquid crystal can miniaturize a display and has the advantage that power consumption is small, the brightness of a screen is inferior in it and it has the problem that whenever [screen angle-of-visibility] is narrow. Furthermore, the number of pixels increased 3 times compared with monochrome screen, equipment became complicated, power consumption increased, and these CRT and liquid crystal also had the problem that a cost rise was not avoided, when making it into a color screen.
[0004]
[Problem(s) to be Solved by the Invention] Therefore, the problem of the conventional display unit is solved, power consumption is small, and moreover can be miniaturized, and the purpose of this invention is to offer the big display component of screen intensity, and a display unit further.
[0005]
[Means for Solving the Problem] Namely, the actuator section which has the piezo electric crystal film and at least one pair of electrodes of both sides of this piezo electric crystal film which cover at least a part, respectively according to this invention, The oscillating section which supports this actuator section in contact with one electrode of the electrodes of this 1 pair, The fixed part which fixes this oscillating section so that this oscillating section can vibrate, and the displacement transfer section linked to this actuator section, It comes to have the photoconductive corrugated plate into which this displacement transfer section is approached, it is arranged, and light is introduced. By impressing an electrical potential difference to said actuator section through said electrode, making quiescence and the variation rate of said actuator section perform, and controlling the contact to said photoconductive corrugated plate of said displacement transfer section, and elongation Display component (invention A) ** characterized by controlling the light leak of the predetermined part of said photoconductive corrugated plate is offered.
[0006] In this invention, the oscillating section and a fixed part are united, the base which consists of ceramics is constituted, and it is desirable to a base that dead air space is formed so that the oscillating section may be pressing hard. Moreover, according to this invention, display unit (invention B) ** characterized by controlling the light leak of the predetermined part of a photoconductive corrugated plate is offered by arranging two or more above-mentioned display components, being constituted, impressing an electrical potential difference to the actuator section through an electrode, making quiescence and the variation rate of the actuator section perform, and controlling the contact to the photoconductive corrugated plate of the displacement transfer section, and elongation.
[0007] Furthermore, the laminating actuator section which has the multilayer piezoelectric transducer with which it comes to carry out two or more laminatings of the piezo electric crystal layer which consists of ceramics, and the electrode layer, respectively according to this invention, The fixed part which fixes this laminating actuator section, and the displacement transfer section linked to this laminating actuator section, It comes to have the photoconductive corrugated plate into which this displacement transfer section is approached, it is arranged, and

light is introduced. By impressing an electrical potential difference to said laminating actuator section through said electrode layer, making quiescence and the variation rate of said laminating actuator section perform, and controlling the contact to said photoconductive corrugated plate of said displacement transfer section, and elongation Display component (invention C) ** characterized by controlling the light leak of the predetermined part of said photoconductive corrugated plate is offered.

[0008] Furthermore, according to this invention, display unit (invention D) ** characterized by controlling the light leak of the predetermined part of a photoconductive corrugated plate is offered again by arranging two or more display components of Invention C, and it being constituted, impressing an electrical potential difference to the laminating actuator section through an electrode layer, making quiescence and the variation rate of the laminating actuator section perform, and controlling the contact to the photoconductive corrugated plate of the displacement transfer section, and elongation.

[0009]

[Function] Radical Motohara ** of this invention is explained based on drawing 1 . Total reflection of the light 2 introduced from the edge of the photoconductive corrugated plate 1 is carried out by adjusting the magnitude of the refractive index of the photoconductive corrugated plate 1, without all the light 2 penetrating in the front face 3 and tooth back 4 of the photoconductive corrugated plate 1. In this condition, if the body (this invention a variation rate transfer section) 5 of arbitration contacts the tooth back 4 of the photoconductive corrugated plate 1 in the distance below the wavelength of light, the light 2 which was carrying out total reflection till then will be penetrated to the front face of the body 5 of the tooth back 4 of the photoconductive corrugated plate 1. Thus, although it reflects on the front face of a body 5, and it invades into the photoconductive corrugated plate 1 again as the scattered light 6, and the light 2 which once arrived at the front face of a body 5 carries out total reflection of a part of scattered light 6 in the photoconductive corrugated plate 1 again, it will penetrate the front face 3 of the photoconductive corrugated plate 1, without reflecting the great portion of scattered light 6.

[0010] The existence of luminescence (light leak) of the light 2 in the front face 3 of the photoconductive corrugated plate 1 is controllable by the existence of contact of the body 5 in the tooth back 4 of the photoconductive corrugated plate 1 clearly from the above thing. Here, if the existence of the above-mentioned luminescence, i.e., the unit which performs turning on and off, is considered to be a pixel, the alphabetic character of arbitration, a graphic form, etc. can be displayed like the conventional CRT and liquid crystal by arranging two or more these pixels in all directions, and controlling turning on and off of a pixel.

[0011] Next, the case where this invention is applied to a color screen is explained. It is thought that recognition of human being's color is performed by mixing in three primary colors which remains on a vision nerve. if it is right [that], the same operation as the present color display which performs mixing in three primary colors to coincidence, and effectiveness will be attained in human being's vision. The basic principle of coloring in this invention is as follows. The base of coloring is prescribed by the mixed method of R (red), G (green), and B (blue) which are the three primary colors of a color.

[0012] Here, it considers trichotomizing the maximum luminescence time amount of RGB, using as T the period made to color. If the ratio of the luminescence time amount of RGB is 4:1:5 as are shown in drawing 2 , and it becomes the white light and is shown in drawing 3 , if the ratio of the luminescence time amount of RGB is 1:1:1, it will become a color corresponding to the ratio. Therefore, if drawing 1 is referred to, it is synchronized with the period which makes the contact

time of the photoconductive corrugated plate 1 and the displacement transfer section 5 color, control of the time amount made to color may control luminescence time amount in three primary colors, can be synchronized with the period which makes luminescence time amount in three primary colors color, and can also control the contact time of the photoconductive corrugated plate 1 and the displacement transfer section 5. Therefore, in this invention, even if it is the case where it is made a color screen, there is an advantage of not making the number of pixels increase as compared with the case of monochrome screen.

[0013]

[Example] Hereafter, although this invention is further explained to a detail based on an example, this invention is not restricted to these examples. Drawing 1 is the schematic diagram showing one example of the display component (invention A) concerning this invention, and the component of a normal state and right-hand side shows [the left-hand side component] the excitation state. In drawing 1 , the actuator section 10 consists of piezo electric crystal film 11 which consists of ceramics, and one pair of electrodes 12 and 13 which cover each field of this piezo electric crystal film 11. Moreover, the base 16 which consists of the oscillating section 14 and a fixed part 15 is arranged, the lower electrode 13 of the actuator section 10 contacts the oscillating section 14, and this actuator section 10 is directly supported by the lower part of the actuator section 10 by the oscillating section 14.

[0014] As for a base 16, it is desirable for the oscillating section 14 and a fixed part 15 to be united, and to consist of ceramics, and it is still more desirable to a base 16 that the crevice 17 is formed so that the oscillating section 14 may be pressing hard. Here, a fixed part 15 is located so that the periphery of the oscillating section 14 may be surrounded. In addition, the fixed part 15 which the oscillating section 14 and a fixed part 15 do not need to be one, for example, is a metal may be fixing the separate oscillating section 14 which is the ceramics. When a fixed part 15 is a metal, metallizing of the front face of the oscillating section 14 linked to a fixed part 15 is carried out, and wax attachment of the metallized layer is carried out at a fixed part 15. Metals, such as stainless steel and iron, may be used for a fixed part 15. Moreover, although a fixed part 15 is located so that the periphery of the oscillating section 14 may be surrounded, it covers the perimeter of the oscillating section 14, does not need to be held at a fixed part 15, and should just be held in a part of oscillating section [at least] 14 at the fixed part 15. At drawing 1 , it is held in a part of oscillating section 14 at the fixed part 15.

[0015] in order to make a touch area with the photoconductive corrugated plate 1 large to predetermined at the up electrode 12 of the actuator section 10 -- a variation rate -- the transfer section 5 connects -- having -- **** -- the example of drawing 1 -- the variation rate -- in the normal state to which the actuator section 10 is standing it still, the transfer section 5 approaches the photoconductive corrugated plate 1, is arranged, and it is arranged so that the photoconductive corrugated plate 1 may be contacted in the distance below the wavelength of light in an excitation state. Drawing 1 shows the case where the displacement transfer section 5 consists of a member of a cross-section triangle.

[0016] Drawing 4 shows other examples of the display component concerning this invention, and shows the case where the displacement transfer section 5 consists of plate member 5a and spherical member 5b. Furthermore, drawing 5 shows the example of further others of the display component concerning this invention, and although it is the same as that of the example of drawing 4 that the displacement transfer section 5 consists of plate member 5a and spherical member 5b, the case where physical relationship of the actuator section 10 and a base 16 is made into drawing 1 , drawing 4 , and reverse is shown further. In addition, if it is in the case of

drawing 5 , there is no need for 15 fixed part of having not necessarily pasted the oscillating section 14, and it may be in the condition of having only contacted. Moreover, although the example shown in drawing 8 shows the same physical relationship as the example of drawing 4 , it makes the displacement direction of the actuator section 10 the example and hard flow of drawing 4 .

[0017] Furthermore, drawing 9 shows still more nearly another example of the display component concerning this invention, and the actuator section 10 which consists of piezo electric crystal film 11 and electrodes 12 and 13 consists of two or more parts in one display component, and it shows the example which consists of a configuration that moreover the oscillating section 14 allotted the thick plate section 31 the sheet metal section 30 and between them. By considering as such a configuration, magnitude of the sheet metal section 30 can be effectively made small, and it is desirable. Moreover, in the case of drawing 1 , drawing 4 , and drawing 5 , the example which the displacement transfer section 5 approaches the photoconductive corrugated plate 1, and is arranged in the normal state to which the actuator section 10 is standing it still, and is arranged so that the photoconductive corrugated plate 1 may be contacted in the distance below the wavelength of light in an excitation state is shown, but Conversely, as shown in drawing 8 and drawing 9 , in the condition that the actuator section 10 is standing it still Of course, it is also possible to constitute so that the displacement transfer section 5 contacts the photoconductive corrugated plate 1 in the distance below the wavelength of light, and the displacement transfer section 5 may approach the photoconductive corrugated plate 1 and may be arranged in an excitation state (isolation). In addition, the contact to the photoconductive corrugated plate 1 of these displacement transfer section 5 and elongation can be suitably controlled by the direction of polarization of a piezo electric crystal, and the direction of drive electric field.

[0018] Drawing 6 shows an example of the laminating actuator section of the display component (invention C) concerning this invention, and the laminating actuator section 20 consists of multilayer piezoelectric transducers 24 with which it comes to carry out two or more laminatings of the piezo electric crystal layer 21 which consists of ceramics, and the electrode layers 22 and 23, respectively. Here, the electrode layer consists of an anode plate electrode 22 of a gestalt which functioned as an anode plate and two or more layers have connected, respectively, and a cathode electrode 23 of a gestalt which functioned as cathode and two or more layers have connected, respectively. Each layer of two or more which forms the anode plate electrode 22 and the cathode electrode 23 is connected so that it may become the polarity same by turns.

[0019] When the multilayer piezoelectric transducer 24 constituted as mentioned above may have the direction of a variation rate as right-angled as the case of being parallel, to the direction of a laminating and is drawing 6 , it will call the direction of a laminating the direction of Y. When the displacement direction is the direction of Y, it is necessary to make the configuration of a multilayer piezoelectric transducer 24 large in the direction of Y as compared with the magnitude of a laminating side. The amount of displacement serves as the sum total of the amount of displacement in the thickness direction of each piezo electric crystal layer 21, and the generating force also serves as the sum total of the number of laminatings. When the displacement direction is the direction of X, it is necessary to make it, as for the configuration of a multilayer piezoelectric transducer 24, the direction of Y become small on the other hand as compared with the magnitude of a laminating side. If it puts in another way, it is necessary to make it long in the direction of X. The amount of displacement turns into the amount of displacement of each piezo electric crystal layer 21 itself, and the number of laminatings is

proportional to the generating force.
[0020] In addition, as shown in drawing 6 and drawing 7 , in making the same the direction of polarization of the piezo electric crystal layer 21, and the direction of drive electric field using the variation rate of the direction of Y, the displacement transfer section 5 considers as the condition of having separated from the photoconductive corrugated plate 1 by the normal state. It is required to change into the condition that the displacement transfer section 5 contacted the photoconductive corrugated plate 1 by the normal state, on the other hand, in making reverse the direction of polarization of the piezo electric crystal layer 21 and the direction of drive electric field. If it puts in another way, in an excitation state, it will be in the condition that it is required to isolate the displacement transfer section 5 from the photoconductive corrugated plate 1, and the excitation state is not emitting light. The laminating actuator section 20 of the display component (invention C) concerning the invention C shown in drawing 6 of the oscillating section like Invention A is unnecessary, and it is supported by the fixed part 25.
[0021] Next, each part which constitutes a display component is explained. if the actuator section 10 excites (i.e., if electrical-potential-difference impression is performed to the vertical electrodes 12 and 13 through the lead section which is not illustrated) -- the piezo electric crystal film 11 -- the thickness direction -- crookedness -- a variation rate is discovered, it is interlocked with, and the oscillating section 14 vibrates in the direction of the vertical direction 1, i.e., a photoconductive corrugated plate, and a crevice 17. Because of the suitable configuration for vibration, as for the oscillating section 14, it is desirable that it is a plate configuration, it is desirable that the thickness of a plate is 1-100 micrometers in this case, its 3-50 micrometers are still more desirable, and its 5-20 micrometers are further in addition desirable.
[0022] As for the oscillating section 14, it is desirable that it is a high thermal-resistance ingredient. In case the direct oscillating section 14 supports the actuator section 10 through the ingredient inferior to the thermal resistance of organic adhesives etc., in order to make it the oscillating section 14 not deteriorate at least at the time of formation of the piezo electric crystal film 11, as for the oscillating section 14, it is desirable that it is a high thermal-resistance ingredient. Moreover, in case a lead, a lead terminal, etc. which are connected to the vertical electrodes 12 and 13 of the actuator section 10 and these which are directly supported by this are formed in the front face of the oscillating section 14, in order to carry out electric separation of the vertical electrodes 12 and 13, as for the oscillating section 14, it is desirable [the oscillating section 14] that it is an electrical insulation material. Therefore, the ceramics is the optimal although the oscillating sections 14 may be ingredients, such as a hoe low which covered the metal of high thermal resistance, or its surface of metal with ceramics, such as glass.
[0023] As ceramics which constitutes the oscillating section 14, the stable zirconium dioxide, an aluminum oxide, a magnesium oxide, a mullite, alumimium nitride, silicon nitride, glass, etc. can be used, for example. The stable zirconium dioxide is especially desirable because of that mechanical strength is high, that toughness is high, the piezo electric crystal film and an electrode, and chemical reactivity being small etc., even if the oscillating section is thin. With the stable zirconium dioxide, a stabilization zirconium dioxide and a partial stabilization zirconium dioxide are included. In the stable zirconium dioxide, since the crystal structures, such as a cubic, are taken, phase transition is not caused. On the other hand, around 1000 degrees C, phase transition of the zirconium dioxide may be carried out by the monoclinic system and ******, and a crack may generate it at the time of this phase transition. the stable zirconium dioxide -- stabilizing agents, such as an oxide of a calcium oxide, magnesium oxide, an oxidization yttrium, scandium oxide, an oxidization ytterbium, cerium oxide, or a rare earth metal, -- 1-30-mol % -- it

contains. In order to raise the mechanical strength of the oscillating section, it is desirable that a stabilizing agent contains yttrium oxide. this time -- yttrium oxide -- desirable -- 1.5-6-mol % -- containing -- further -- desirable -- 2-4-mol % -- it contains. Furthermore, although crystal phases may be the mixed phase of a cubic + monoclinic system, the mixed phase of a tetragonal + monoclinic system, a mixed phase of a cubic + tetragonal + monoclinic system, etc., what the main crystal phase made the mixed phase of a ****** or tetragonal + cubic is the most desirable [crystal phases] from a viewpoint of reinforcement, toughness, and endurance especially.
[0024] It is desirable that the ceramics which constitutes the oscillating section 14 contains 0.5 - 5% of the weight of oxidation silicon, and it is still more desirable to contain 1 - 3% of the weight of oxidation silicon. Oxidization silicon can avoid the superfluous reaction of the oscillating section 14 and the actuator section 10, and this can acquire a good actuator property, when heat-treating and forming the actuator section 10. Moreover, in order to raise the mechanical strength of the oscillating section although much crystal grain constitutes the oscillating section when the oscillating section 14 consists of ceramics, as for the mean particle diameter of crystal grain, it is desirable that it is 0.05-2 micrometers, and it is still more desirable that it is 0.1-1 micrometer.
[0025] A fixed part 15 fixes a part of oscillating section [at least] 14 so that the oscillating section 14 can vibrate. In the embodiment of drawing 1 , although consisting of ceramics is desirable as for a fixed part 15, the same ceramics as the ingredient of the oscillating section 14 is sufficient as it, and they may differ. As ceramics which constitutes a fixed part 15, the stable zirconium dioxide, an aluminum oxide, a magnesium oxide, a mullite, alumimium nitride, silicon nitride, glass, etc. can be used like the ingredient of the oscillating section 14.
[0026] Especially the configuration of a crevice 17 is not restricted. The configuration of the horizontal section of a crevice 17 or a vertical section may be a polygon containing circular, an ellipse form or a square, and a rectangle, or a compound configuration which combined these configurations. However, being bordered so that a corner may be roundish is desirable at the time of configurations, such as a polygon.
[0027] The actuator section 10 consists of piezo electric crystal film 11, an up electrode 12 which covers 11s of a part of one front face [at least] of this piezo electric crystal film 11, and a lower electrode 13 which covers 11t of a part of other front faces [at least] of the piezo electric crystal film 11. The lower electrode 13 covers 14s of a part of front faces [at least] of the oscillating section 14. the piezo electric crystal film 11 impresses an electrical potential difference to the up electrode 12 and the lower electrode 13 -- crookedness -- what generates a variation rate -- it is -- this case -- the piezo electric crystal film 11 -- that thickness direction -- crookedness -- it is desirable that it is what a variation rate discovers. When the piezo electric crystal film 11 carries out crookedness displacement, the displacement transfer section 5 vibrates in the film thickness direction of the piezo electric crystal film 11 with the oscillating section 14, and the displacement transfer section 5 contacts the photoconductive corrugated plate 1.
[0028] As for the thickness of the piezo electric crystal film 11, it is desirable that it is 5-100 micrometers, its 5-50 micrometers are still more desirable, and its 5-30 micrometers are further in addition desirable. Although piezoelectric ceramics can be suitably used for the piezo electric crystal film 11, even if you may be the electrostriction ceramics or the ferroelectric ceramics and it is the ingredient which still needs polarization processing, you may be an ingredient without the need. Furthermore, you may be the piezo electric crystal which consists of a macromolecule which is not limited to the ceramics but is represented by PVDF (polyvinylidene fluoride) again, or the complex of these macromolecules and the ceramics. The ceramics with which the

ceramics used for the piezo electric crystal film 11 contains which [these] combination, such as lead zirconate, magnesium niobic acid lead, nickel niobic acid lead, zinc niobic acid lead, manganese niobic acid lead, antimony stannic-acid lead, lead titanate, barium titanate, a magnesium lead wolframate, and cobalt niobic acid lead, is mentioned. It cannot be overemphasized that these compounds may be the principal components which occupy 50 % of the weight or more. Moreover, the ceramics containing lead zirconate is used preferably. The ceramics which added suitably oxides, such as a lanthanum, calcium, strontium, molybdenum, a tungsten, barium, niobium, zinc, nickel, and manganese, which [these] combination, or other compounds may be further used for the above-mentioned ceramics. For example, it is desirable to use the ceramics which uses as a principal component the component which consists of magnesium niobic acid lead, lead zirconate, and lead titanate, and contains a lanthanum and strontium further.

[0029] The piezo electric crystal film 11 may be precise, or may be porosity, and it is [porosity] desirable at the time of porosity that it is 40% or less. In addition, it has the quality of the material as the above-mentioned piezo electric crystal film 11 also with the same piezo electric crystal layer 21 which constitutes a part of laminating actuator section 20 in the display component of the above-mentioned invention C, and the display unit of Invention D, and a property.

[0030] Although the vertical electrodes 12 and 13 are made into proper thickness according to an application, it is desirable that it is the thickness of 0.1-50 micrometers. The up electrode 12 is a solid-state at a room temperature, and it is desirable to consist of conductive metals. For example, the metal simple substance or alloy containing aluminum, titanium, chromium, iron, cobalt, nickel, copper, zinc, niobium, molybdenum, a ruthenium, a rhodium, silver, tin, a tantalum, a tungsten, iridium, platinum, gold, lead, etc. is mentioned. It cannot be overemphasized that these elements may contain in the combination of arbitration.

[0031] As for the lower electrode 13, it is desirable to consist of the simple substance or alloy containing a metal high-melting [, such as platinum, a ruthenium a rhodium, palladium, iridium, titanium, chromium, molybdenum, a tantalum, a tungsten nickel, and cobalt]. Moreover, it cannot be overemphasized that these refractory metals may contain in the combination of arbitration. Moreover, it is desirable that platinum metals, such as platinum, a rhodium, and palladium, contain, and the electrode material which uses alloys containing platinum metals, such as platinum, a rhodium, and palladium, or these platinum metals, such as silver-platinum and platinum-palladium, as a principal component is used suitably. Since the lower electrode 13 may be exposed to an elevated temperature at the time of heat treatment of the piezo electric crystal film 11, it is desirable that it is the metal which can bear a high-temperature-oxidation ambient atmosphere. Moreover, you may be a cermet containing these refractory metals, an alumina, a zirconium dioxide, silicon oxide, glass, etc.

[0032] In addition, in the display component of the above-mentioned invention C, and the display unit of Invention D, although what is necessary is just to use as the same ingredient as the above-mentioned up electrode 12 or the above-mentioned lower electrode 13 the electrode layers 22 and 23 which constitute a part of laminating actuator section 20, they are heat-treated at baking and coincidence of the piezo electric crystal layer 21, or comparable temperature. Moreover, a fixed part 25 may consist of same ingredients as the above-mentioned fixed part 15, and its thing of the laminating actuator section 20 a part [thing] is supposed is desirable.

[0033] The displacement transfer section 5 connected to the up electrode 12 of the actuator section 10, the oscillating section 14, or the laminating actuator section 20 contacts to the tooth

back 4 of the photoconductive corrugated plate 1 corresponding to the variation rate of the actuator section 10 or the laminating actuator section 20. If the displacement transfer section 5 contacts the tooth back 4 of the photoconductive corrugated plate 1, the light 2 which was carrying out total reflection within the photoconductive corrugated plate 1 will penetrate the tooth back 4 of the photoconductive corrugated plate 1, will penetrate to the front face of the displacement transfer section 5, and will reflect on the front face of the displacement transfer section 5. Thus, since the displacement transfer section 5 reflects the light 2 which penetrated the tooth back 4 of the photoconductive corrugated plate 1, it is prepared in order to make a touch area with the photoconductive corrugated plate 1 larger than predetermined further. That is, luminescence area is prescribed by the touch area of the displacement transfer section 5 and the photoconductive corrugated plate 1. In addition, contact means that the displacement transfer section 5 and the photoconductive corrugated plate 1 are located in the distance below the wavelength of light here.

[0034] The displacement transfer section 5 has the desirable thing of the degree of hardness of extent which transmits the variation rate of the actuator section 10 to the direct photoconductive corrugated plate 1. Therefore, in order to satisfy the above-mentioned property, as the quality of the material of the displacement transfer section 5, rubber, organic resin, glass, etc. are mentioned as a desirable thing, but it does not matter at all even if it is the quality of the material of the electrode layer itself, a piezo electric crystal, or the above-mentioned ceramics. moreover, a variation rate -- the display flatness of the part (field) to which the transfer section 5 contacts the photoconductive corrugated plate 1 -- the variation rate of the actuator section 10 -- 1 micrometer or less 0.5 micrometers or less is specifically [it is desirable to make it small enough as compared with an amount, and] 0.1 micrometers or less especially preferably still more preferably. however, a variation rate -- the display flatness of the part (field) in contact with the photoconductive corrugated plate 1 of the transfer section 5 -- a variation rate -- if a contact part deforms in the condition of it having been important and having contacted in order that the transfer section 5 may reduce the clearance in the condition of having contacted the photoconductive corrugated plate 1, it will not necessarily be limited to the above-mentioned display flatness.

[0035] Moreover, as shown in drawing 10 , it is also possible to constitute so that the liquid 32 of translucency may be made to intervene between the actuator section 10 or the displacement transfer section 5 (for the up electrode 12 to make the displacement transfer section serve a double purpose in drawing 10 .), and the photoconductive corrugated plate 1 and the translucency liquid 32 concerned may form a part of photoconductive corrugated plate 1 in it. In this case, in order that the translucency liquid 32 may reduce effectively the clearance between the actuator section 10, the photoconductive corrugated plate 1, or the displacement transfer section 5 and the photoconductive corrugated plate 1, the on-off control of light becomes easy. Here, it is desirable to adopt the structure which closes the actuator section 10 airtightly between the photoconductive corrugated plates 1 as a translucency liquid 32, for example, in order to be able to mention the organic solvent of low vapor pressure, an oil, etc. and to prevent evaporation of the translucency liquid 32. Moreover, in making the translucency liquid 32 which has a fluidity hold on the actuator section 10, the technique of the conventional common knowledge, such as preparing the wall of height in the top periphery section of the actuator section 10 suitably, is applicable, for example, but the concave convex of the displacement transfer section 5 or the porous section can be used, and the translucency liquid 32 can also be held in the condition of having sunk into this. These are held with the surface tension of the translucency

liquid 32.
[0036] The photoconductive corrugated plate 1 of this invention needs to be what has a refractive index in which the light introduced into the interior penetrates and carries out total reflection to the exterior of the photoconductive corrugated plate 1 in a front face 3 and a tooth back 4. Although especially the quality of the material will not be restricted if such a property is provided, specifically, glass, a quartz, translucency plastics, translucent ceramics, etc. are mentioned as what has two or more general layer structure of an ingredient which has a different refractive index, the general thing which prepared the coating layer in the front face.
[0037] the display component explained above by this invention -- a predetermined number -- although the display unit which can display the alphabetic character of arbitration, a graphic form, etc. like the conventional CRT and liquid crystal can be offered by controlling turning on and off of a display component if it arranges suitably, there is no need that a display component is plurality, and it is not necessary to necessarily say that it is good only at one piece
[0038] Next, the manufacture approach of the display component of this invention is explained. A base 16 can be unified by carrying out the laminating of the shaping layer which is a green sheet or a green tape, and subsequently sintering it by thermocompression bonding etc. For example, what is necessary is just to prepare beforehand the through tube of the predetermined configuration which serves as a crevice 17 at the second layer in front of the laminating in the base 16 of drawing 1 , although the laminating of a two-layer green sheet or a two-layer green tape is carried out. Moreover, a shaping layer may be created with the pressing and the slip casting using a die, injection molding, etc., and a crevice etc. may be prepared by machining of punching by cutting, the grinding process, laser processing, and press working of sheet metal etc.
[0039] The actuator section 10 is formed on the oscillating section 14. A piezo electric crystal is fabricated by the press-forming method using metal mold, or the tape-forming method using a slurry raw material, the laminating of the piezo electric crystal before this sintering is carried out to the oscillating section 14 in the substrate before sintering by thermocompression bonding, it sinters to coincidence, and there is the approach of forming a substrate and the piezo electric crystal film. In this case, it is necessary to form electrodes 12 and 13 in a piezo electric crystal beforehand by the film forming method mentioned later. Although the sintering temperature of the piezo electric crystal film 11 is suitably defined with the ingredient which constitutes this, generally, it is 800 degrees C - 1400 degrees C, and is 1000 degrees C - 1400 degrees C preferably. In this case, in order to control the presentation of the piezo electric crystal film 11, it is desirable to sinter under existence of the evaporation source of a piezo electric crystal film ingredient.
[0040] On the other hand, by the film forming method, the laminating of the lower electrode 13, the piezo electric crystal film 11, and the up electrode 12 is carried out to this sequence, and the actuator section 10 is formed in the oscillating section 14. Although film methods, such as the applying methods, such as the well-known film forming method, for example, the thick-film method like screen-stencil, and dipping, an ion beam, sputtering, vacuum deposition, ion plating, chemical vapor deposition (CVD), and plating, etc. are used suitably, it is not limited to these at all. Printing spreading of the lower electrode 13, the lead which is not illustrated, and the terminal pad can be carried out by screen-stencil at coincidence. Moreover, the piezo electric crystal film 11 is preferably formed by the thick-film formation approaches, such as screen-stencil. Film formation of such technique can be carried out on a substrate using the paste and slurry which use as a principal component the ceramic particle which consists of an ingredient of the piezo electric crystal film, and a good piezo electric crystal property is acquired. Moreover, if

the piezo electric crystal film is formed by the film forming method in this way, since the actuator section 10 and the oscillating section 14 can be joined in one, without using adhesives, it excels in dependability and repeatability and is especially more desirable still from being easy to integrate. Moreover, the configuration of such film may form a suitable pattern. By screen printing, the photolithography method, etc., pattern formation may be carried out, and pattern formation of the unnecessary part may be removed and carried out using the machining methods, such as a laser process, slicing, and ultrasonic machining. Screen printing is the most desirable from a industrial viewpoint especially.

[0041] Moreover, the configuration of the piezo electric crystal film produced, an up electrode, and a lower electrode is not limited at all, and what kind of configuration may be used for it according to an application. For example, you may be the special configuration which combined the shape of curvilinear configurations, such as a polygon of a triangle, a square, etc., a circle, an ellipse, and a circular ring, and Kushigata, the shape of a grid, and these. And after heat-treating each film (11, 12, 13) which did in this way and was formed in the shape of a substrate, and making it serve as a substrate and integral construction at every formation of each film or forming these film, it may heat-treat these film to coincidence, and each film may make it join it to a substrate in one. In addition, in forming an up electrode or a lower electrode with a film method, in order to unify these electrodes, heat treatment is not necessarily needed.

[0042] a variation rate -- if it is when using said ingredient carried out for the transfer section 5 -- the actuator section 10 and a variation rate -- the connection with the transfer section 5 -- adhesives -- using -- the variation rate of said ingredient carried out -- what is necessary is to carry out the laminating of the transfer member, or just to carry out by forming in the upper part of the actuator section 10 by the approach of coating the solution thru/or slurry of said ingredient Then, although it is not necessarily required to make the displacement transfer section 5 cut so that it may become the same as that of the configuration of the actuator section 10 in general, in order to make the variation rate of the actuator section 10 efficient, it is desirable to cut the layer of the displacement transfer section 5, or to prepare notching. a variation rate -- the predetermined distance after the assembly of the transfer section 5 and the photoconductive corrugated plate 1 -- the variation rate of the actuator section 10 -- although it cannot be overemphasized that it is necessary to make it small as compared with an amount, it is desirable to prepare the clearance formation member of predetermined magnitude in the part in which the actuator section 10 does not exist, and to fix closely a fixed part 15 and the photoconductive corrugated plate 1 to it.

[0043] In addition, it can manufacture about the laminating actuator section 20 shown in drawing 6 as well as the actuator section 10, and can carry out like the invention A and B which also described above the connection between the laminating actuator section 20 and the displacement transfer section 5, and support by the fixed part 25 of the laminating actuator section 20.

[0044] In the case of the laminating actuator section 20, it is most desirable to carry out the predetermined number-of-layers laminating of what formed the electrode layer in one side of the piezo electric crystal layer 21 since it was suitable to make a fixed part 25 into a part of laminating actuator section 20 and a fixed part 25 was not necessarily required, and to consider as two or more laminating actuator sections 20 by calcinating a layered product and cutting the predetermined part of the thickness of a layered product after that. Moreover, after carrying out the predetermined number-of-layers laminating of the piezo electric crystal layer 21 and the electrode layers 22 and 23 by turns on the substrate which does not exist during baking, a layered product is exfoliated from a substrate and, subsequently a layered product may be calcinated.

Cutting may be performed before baking further again. When it is desirable to consider as an equivalent for 0.3mm angle - 3mm angle as for the magnitude of the pixel in this invention and it is a large pixel, it will be comparatively suitable for a big screen display. Moreover, in the display unit of this invention, when arranging two or more display components of N(length) xM (width), it is good also as a configuration which arranges the part of axb as what did not necessarily need to deal with all components to one, and was divided into the part of a (N/a)x(M/b) unit.

[0045] As mentioned above, although this invention has been concretely explained based on some examples, this invention can add modification which becomes various, correction, amelioration, etc. based on this contractor's knowledge, unless it should be limited to the above-mentioned example in any way, and should not be interpreted and it deviates from the range of this invention.

[0046]

[Effect of the Invention] Since luminescence is controlled using the variation rate by the piezo-electric effect of the piezo electric crystal film and a piezo electric crystal layer according to this invention as explained above, a speed of response can be quick, power consumption can be small, it can miniaturize, and, moreover, screen intensity can offer a large display component and a large display unit. Moreover, it is not necessary to make the number of pixels increase as compared with monochrome screen also in the case of a color screen. Moreover, it is applicable to other applications, such as an optical switch.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The schematic diagram showing one example of the display component (invention A) concerning this invention.

[Drawing 2] The explanatory view showing an example of the ratio of the luminescence time amount of RGB.

[Drawing 3] The explanatory view showing other examples of the ratio of the luminescence time amount of RGB.

[Drawing 4] The schematic diagram showing other examples of the display component concerning this invention.

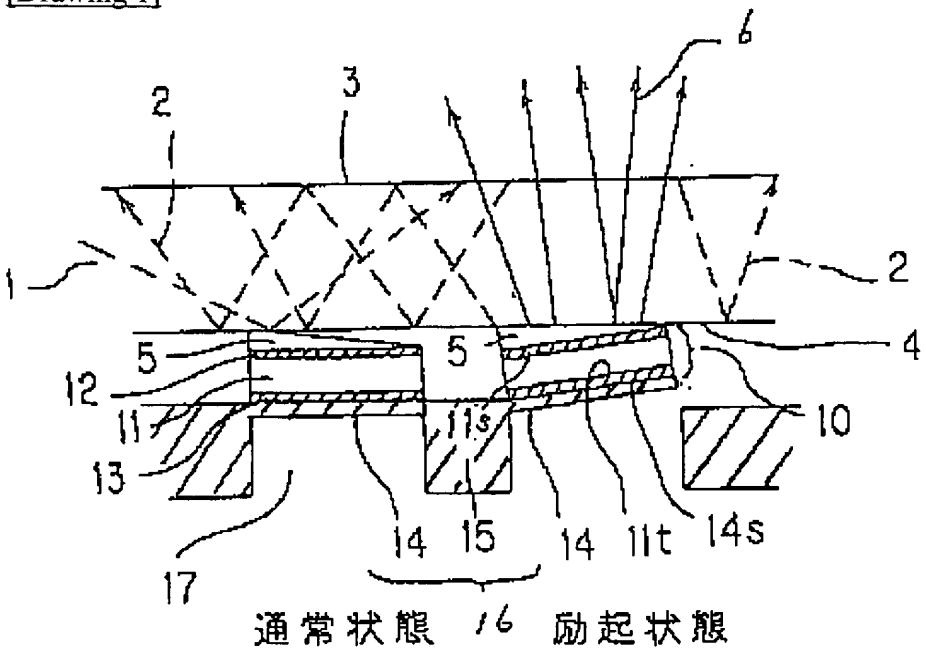
[Drawing 5] The schematic diagram showing the example of further others of the display component concerning this invention.

[Drawing 6] The schematic diagram showing an example of the laminating actuator section of the display component (invention C) concerning this invention.
[Drawing 7] The schematic diagram showing the normal state and excitation state of the laminating actuator section of Invention C.
[Drawing 8] The schematic diagram showing the example of further others of the display component concerning this invention.
[Drawing 9] The schematic diagram showing the example of further others of the display component concerning this invention.
[Drawing 10] The schematic diagram showing the example of further others of the display component concerning this invention.
[Explanation of agreement]
1 [.. The tooth back of a photoconductive corrugated plate,] .. Photoconductive corrugated plates 1 and 2 .. Light, 3 .. The front face of a photoconductive corrugated plate, 4 5 .. The displacement transfer section (body of arbitration), 6 .. The scattered light, 10 .. Actuator section, 11 [.. Oscillating section,] .. The piezo electric crystal film, 12 .. An up electrode, 13 .. A lower electrode, 14 15 [.. The laminating actuator section 21 / .. 22 A piezo electric crystal layer, 23 / .. An electrode layer, 24 / .. A multilayer piezoelectric transducer, 25 / .. A fixed part, 30 / .. The sheet metal section, 31 / .. The thick plate section, 32 / .. Translucency liquid] .. A fixed part, 16 .. A base, 17 .. A crevice, 20

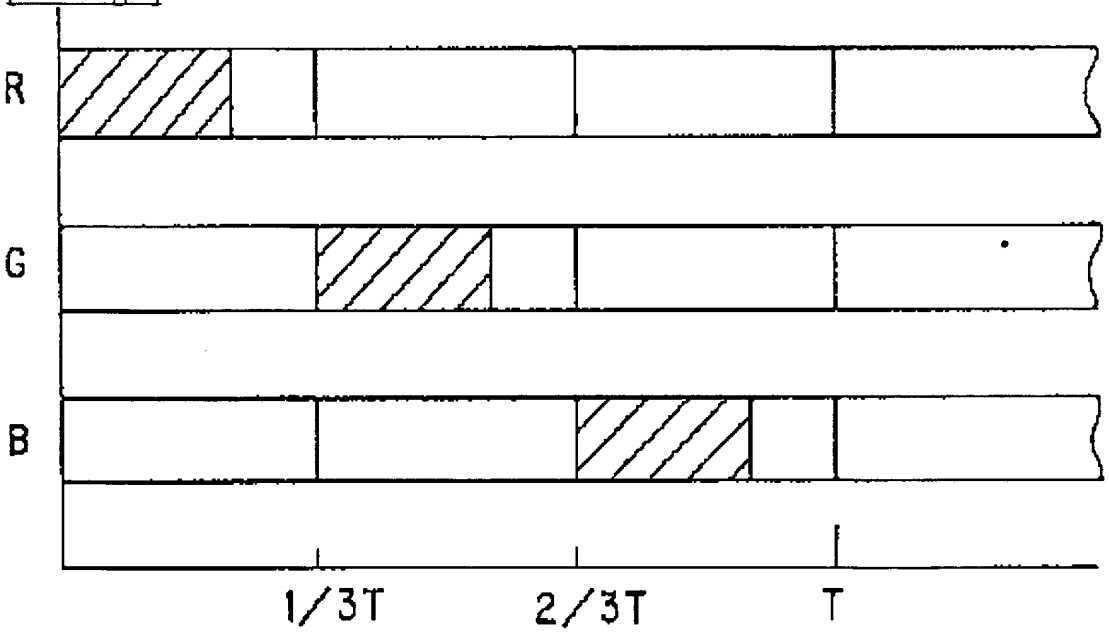
[Translation done.]

DRAWINGS

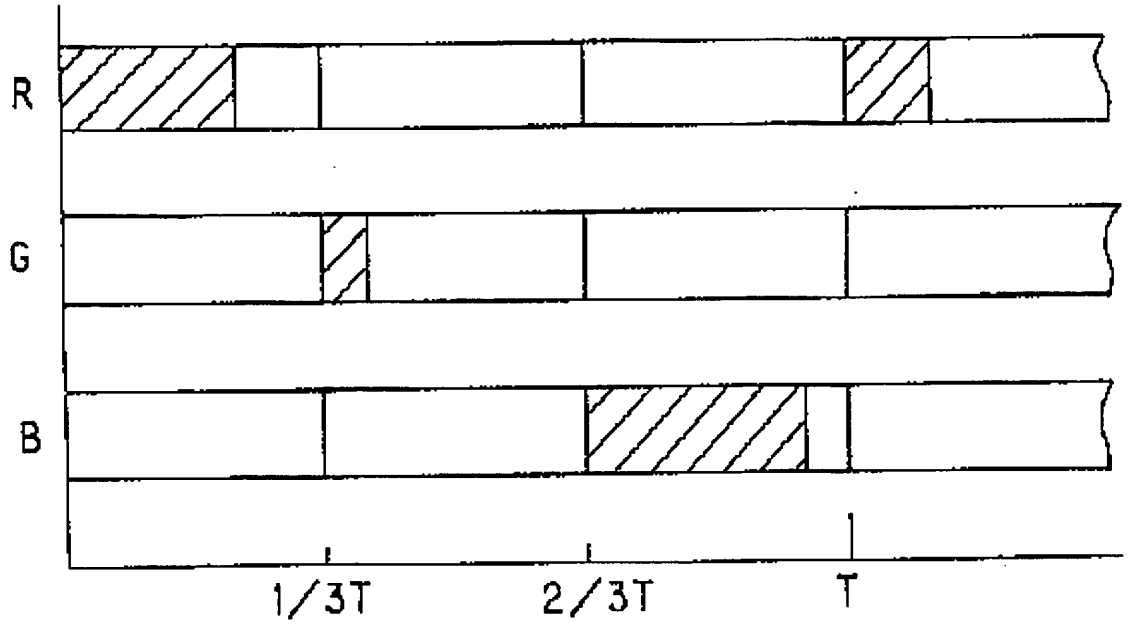
[Drawing 1]



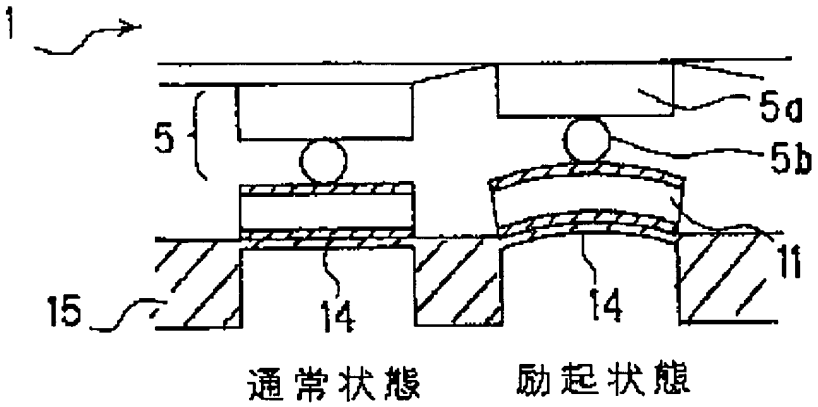
[Drawing 2]



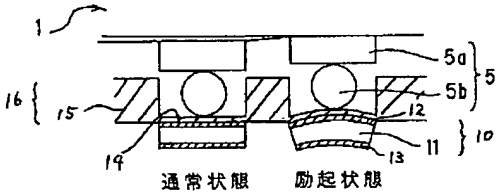
[Drawing 3]



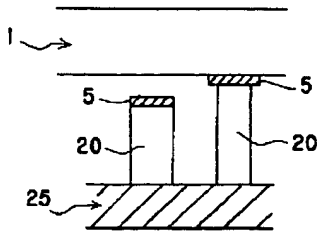
[Drawing 4]



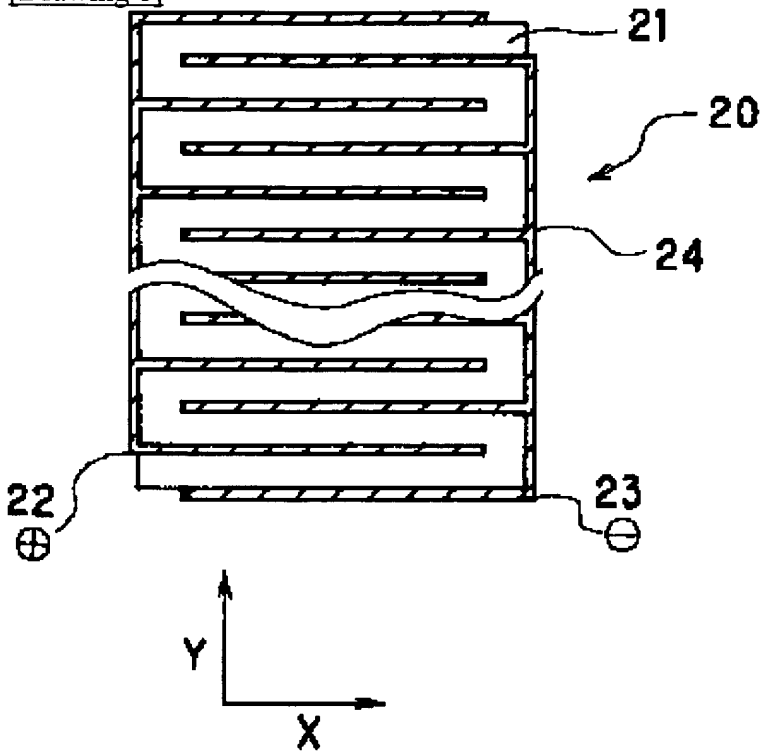
[Drawing 5]



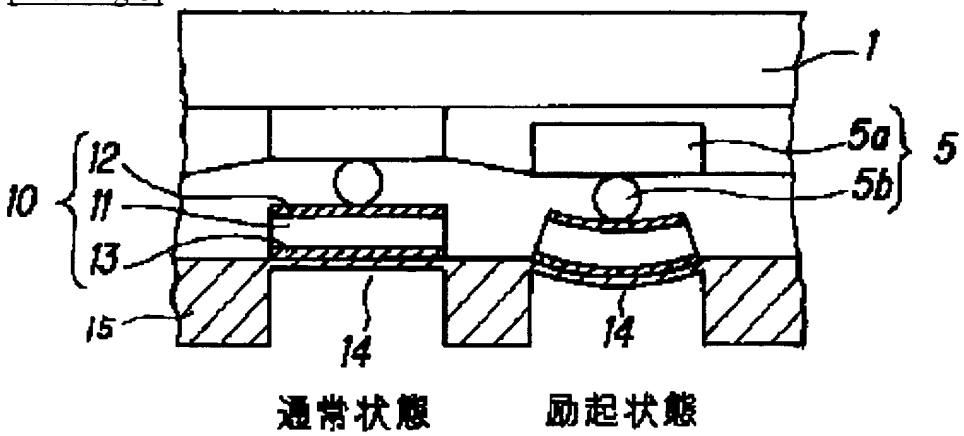
[Drawing 7]



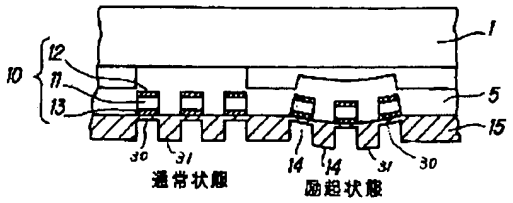
[Drawing 6]



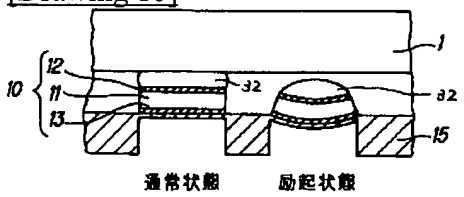
[Drawing 8]



[Drawing 9]



[Drawing 10]



[Translation done.]